

鬼笔腹菌在东亚首次发现^{*}

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摘要：根据采自我国四川的材料和对模式标本的研究，对鬼笔腹菌（*Phallogaster saccatus*）的特征进行了详细描述，并附有插图。该种所隶属的鬼笔腹菌属（*Phallogaster*）为一个单型属，在东亚为首次报道。其主要特征是包被单层，表面有不规则的下陷，成熟时下陷处发育成不规则小孔；孢体由不规则的小腔组成，成熟时与中柱一并全部胶化溶解，仅剩下深绿色至橄榄色的孢子成堆附着在包被的内表面；担子果无菌托，成熟时袋状、中空。
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Phallogaster saccatus (Basidiomycetes, Fungi),
First Record from East Asia^{*}

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Abstract: *Phallogaster saccatus* is reported, described and illustrated from East Asia for the first time. It is characterized by its sac-like, single-layered peridium with irregularly shaped thin depressed areas which becomes perforated, the columella that deliquesces and entirely disappears by maturity, the olivaceous spore mass (adhering to the inner surface of the otherwise hollow basidioma) that breaks irregularly when mature, the absence of a volva and the bacilliform to cylindric, smooth basidiospores with a nearly truncate base and a short sterigmal appendage. The genus *Phallogaster* is currently viewed as monotypic.
Key words: Phallogastraceae; *Hysterangiales*; Taxonomy

Montane southwestern China is one of the world's 34 hotspots of biodiversity (Boufford and van Dijk, 2000; Mittermeier *et al.*, 2005). The fauna and flora there are relatively better known than the mycota. In the last ten years, mycological expeditions to the regions have been taken annually, and many fungal collections have been made. A taxonomic study revealed that the genus *Phallogaster* occurs there. This genus has not been reported from Asia before.

Materials and methods

Mature and developing basidiomata were collected in a forest dominated by *Picea* and *Abies* in Sichuan Province, China. Specimens were annotated and/or photographed in the field. Colour codes of the form "2B2" indicate a colour sample, row, and colour block in Kornerup and Wanscher (1981). Specimens were

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dried in an electric drier, and then deposited in herbaria. Herbarium abbreviations follow Holmgren *et al.* (1990) with one exception: HKAS—the Herbarium of Cryptogams, Kunming Institute of Botany, Chinese Academy of Sciences.

Tissues were mounted in 3–5% KOH and Melzer's reagent for microscopic examination. *Q* refers to the length/width ratio of basidiospores; *Q* refers to the average *Q* of all basidiospores \pm sample standard deviation.

Taxonomy

Phallogaster saccatus Morgan, Journ. Cincinnati Soc. Nat. Hist. **15**: 171, 1893. Fig. 1: 1–7

Basidiomata (figs. 1–3) scattered to gregarious, 3–5 cm \times 2–3 (4) cm, ovoid to subglobose to piriform when young, becoming ovoid to piriform or subellipsoid when mature, hollow to very base at maturity; stipe short to nearly sessile, up to 1.5 \times 1 cm, whitish, attenuate towards base with white rhizomorphs; volva absent. **Peridium** single-layered, 1–2 mm thick, with surface glabrous, pale olivaceous (2B2–2C2, 3B2, 29B2–29B3), but often with pinkish tinge (6A2–6B2) especially in lower parts, with irregularly shaped, thin, lighter colored, depressed areas becoming perforate at mature, then with holes 0.3–0.7 (1.2) cm wide, finally often breaking irregularly at apex. **Gleba** at first irregularly lobed, olivaceous green (29D4–29D5), viscid, with gelatinous tramal plates and with irregular to angular, minute locules; at maturity entirely deliquesced and leaving slimy spore mass adhering to inner surface of peridium. **Columella** extending from base of basidioma to center of gleba, branching and penetrating gleba and separating its lobes, gelatinous and translucent, entirely deliquesced and absent at maturity. **Spore mass** mucilaginous, dark green to olivaceous (30F4–30F6), adhering in irregular sizes and shapes to inner surface of mature peridium. **Odor** not repugnant, weakly chive (*Allium tuberosum*)-like.

Basidiospores (Fig. 1: 5, 7) [40/2/1] (4.5) 5.0–6.5 (7.0) \times 1.8–2.3 (2.5) μm , *Q* = (1.8) 2.27–3.33 (3.61), *Q* = 2.68 \pm 0.35, statismorphic, orthotropic, oblong to bacilliform to cylindric, greenish to nearly colorless and hyaline in KOH, smooth, thin-walled, non-amyloid, non-dextrinoid; base nearly truncate, with very short sterigmal append-

age. **Basidia** (Fig. 1: 4, 6) 20–32 \times 4–6 μm , clavate to narrowly clavate, 6–8-spored; sterigmata < 0.5 μm long. **Cystidia** absent. **Tramal plates** (Fig. 1: 4) 80–200 μm thick, with subparallel to loosely interwoven, multibranched hyphae 2–4 (6) μm broad, hyaline, thin-walled, strongly gelatinized. **Peridiopellis** well differentiated, dominantly consisting of subfusiform or ellipsoid, sometimes ovoid, thin-walled, colorless and hyaline, non-gelatinous inflated cells 10–20 (30) μm broad and in chains, and mixed with scattered to locally abundant (on inner surface of peridiopellis, abundant), non-gelatinized filamentous hyphae 2–7 μm broad; outer surface of peridiopellis bearing relatively common \pm peripherally arranged, 2–6 μm broad filamentous hyphae with yellowish to ochreous contents in KOH; thin, depressed areas of peridium dominantly consisting of gelatinized filamentous hyphae 2–5 μm wide. **Clamp connections** common in all parts of basidioma.

Habit, habitat, distribution and season—Fruiting in summer; scattered to gregarious, among fallen wood in forest dominated by *Picea* and *Abies*; North America (Canada, Mexico and USA), Central America (Costa Rica), Europe (Austria, France, Germany, Hungary, Italy, Poland, Slovakia, Slovenia, Spain, Switzerland, and Turkey), new to East Asia.

COLLECTIONS EXAMINED—China, SICHUAN PROVINCE, Xiangcheng County, Reda, alt. 3700 m, 15.VII.2004, Z. L. Yang 4127 (HKAS 45512). USA, OHIO STATE, Preston, 18.IV.1892, A. P. Morgan s. n. (FH 1142-holotype).

Discussion

The above description is based on a collection made in southwestern China. In comparison with other descriptions of this species (e.g. Fitzpatrick, 1913; Lohwag, 1936; Thaxter, 1893; Aron *et al.*, 2006), the Chinese collection has a slightly longer and broader basidiospores. The holotype, consisting of a half basidioma, was probably not fully mature when dried. The basidiospores from the holotype are [15/1/1] 4.5–5.5 (6.0) \times (1.5) 1.8–2.0 (2.2) μm , *Q* = (2.4) 2.5–3.0 (3.06), *Q* = 2.70 \pm 0.19 (Fig. 1: 7). *Phal-*

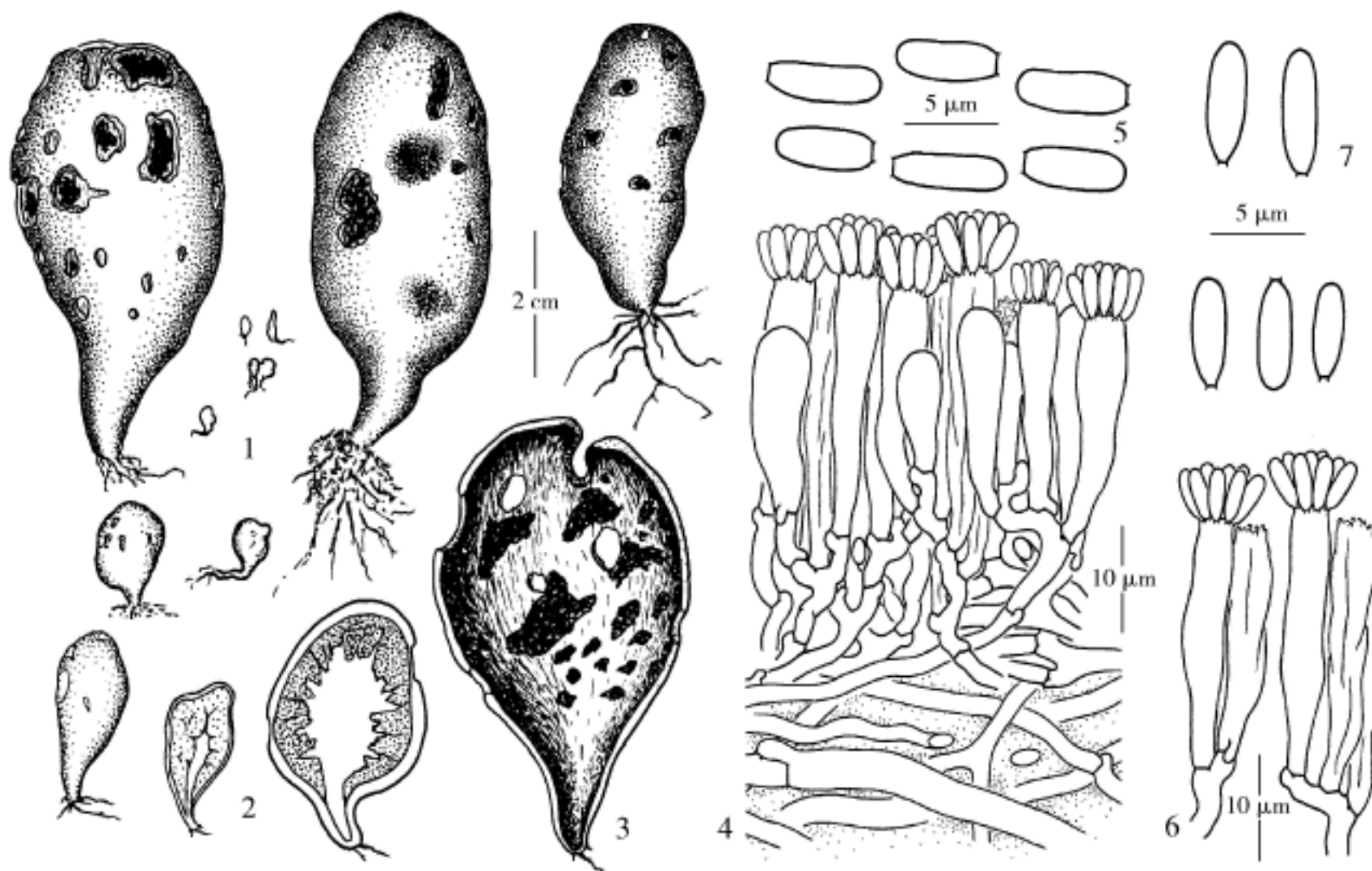


Fig. 1: 1-5: *Phallogaster saccatus* (HKAS 45512): 1. Basidiomata at different stages of development. Note young basidiomata with irregularly shaped, thin, lighter colored, depressed areas, which perforate as holes in mature basidiomata; 2. Basidiomata in longitudinal sections showing peridium, gleba and columella. Note the right basidioma with two thin and depressed areas which become holes in later development; 3. Gleba and columella entirely deliquesced and left slimy spore mass adhering to the inner face of the peridium, and basidioma becomes hollow to its very base; 4. Tramal plate, subhymenium and hymenium from the right basidioma in fig. 1: 2; 5. Basidiospores from a spore mass in fig. 1: 3. 6-7: Basidia and basidiospores of *P. saccatus* (FH 1142-holotype). The holotype consists of half of a longitudinally split basidioma dried at a stage of development comparable to the left basidioma of fig. 1: 2

logaster saccatus was originally described from eastern North America and later found in Europe and Central America (e.g. Morgan, 1893; Lloyd, 1907; Lothwag, 1936; Furia and Bemicchia, 1983; Gross, 1978; Krieglsteiner, 1991; Calonge *et al.*, 2005; Aron *et al.*, 2006; Doğan, 2006). The present article reports this taxon occurring outside America and Europe for the first time.

The systematic arrangement of *Phallogaster* was long under dispute. Morgan (1893) and Thaxter (1893) regarded the genus as a member of the Phalloideae, one of the four subdivisions (Phalloideae, Hymenogastreae, Nidularieae, and Lycoperdaceae) of Gasteromycetes at that time. Fischer (1899) placed it in the Hysterangiaceae of Hymenogastrineae near *Protuberata*, which assignment was followed by Fitzpatrick (1913). Coker and Couch (1928) and Johnson

(1929) placed *Phallogaster* in the Hysterangiaceae of Gasteromycetes and Clathraceae of Phallales respectively, while Gäumann (1964) and Dring (1973) placed it in Hysterangiaceae of Phallales. Jülich (1981) placed it in Hysterangiaceae of Hysterangiales. In their molecular phylogenetic analysis, Hosaka *et al.* (2007) provided evidence supporting placement of *Phallogaster* and its relatives (some *Protuberata*-like and *Trappea*-like taxa) in a newly named, independent family, namely Phallogastraceae, in the Hysterangiales of Phallomycetidae.

In the literature two additional species have been described in *Phallogaster*, i.e., *P. whitei* Peck (1907) and *P. globosus* Lloyd (1917). *Phallogaster whitei* is a depauperate form of *P. saccatus* according to Lloyd (1909). *Phallogaster globosus* was originally described from New Zealand. Cunningham (1944) sug-

gested that the species was based on an “egg” of some phalloid, “probably that of *Clathrus cibarius*”. However, Castellano and Beever (1994) suspected that it represents a species of *Protuberata*. To date the genus *Phallogaster* is still monotypic. Research indicating molecular differentiation between populations of different continents is not known to us.

Kobayasia nipponica (Kobayasi) S. Imai & A. Kawam. (*Protuberata nipponica* Kobayasi) also occurs in southwestern China and is somewhat similar to *P. saccatus*. However, the former can easily be distinguished from the latter by its concentrically arranged, non-deliquesced gleba and a complete peridium without holes (Liu 1994; Liu 2005).

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